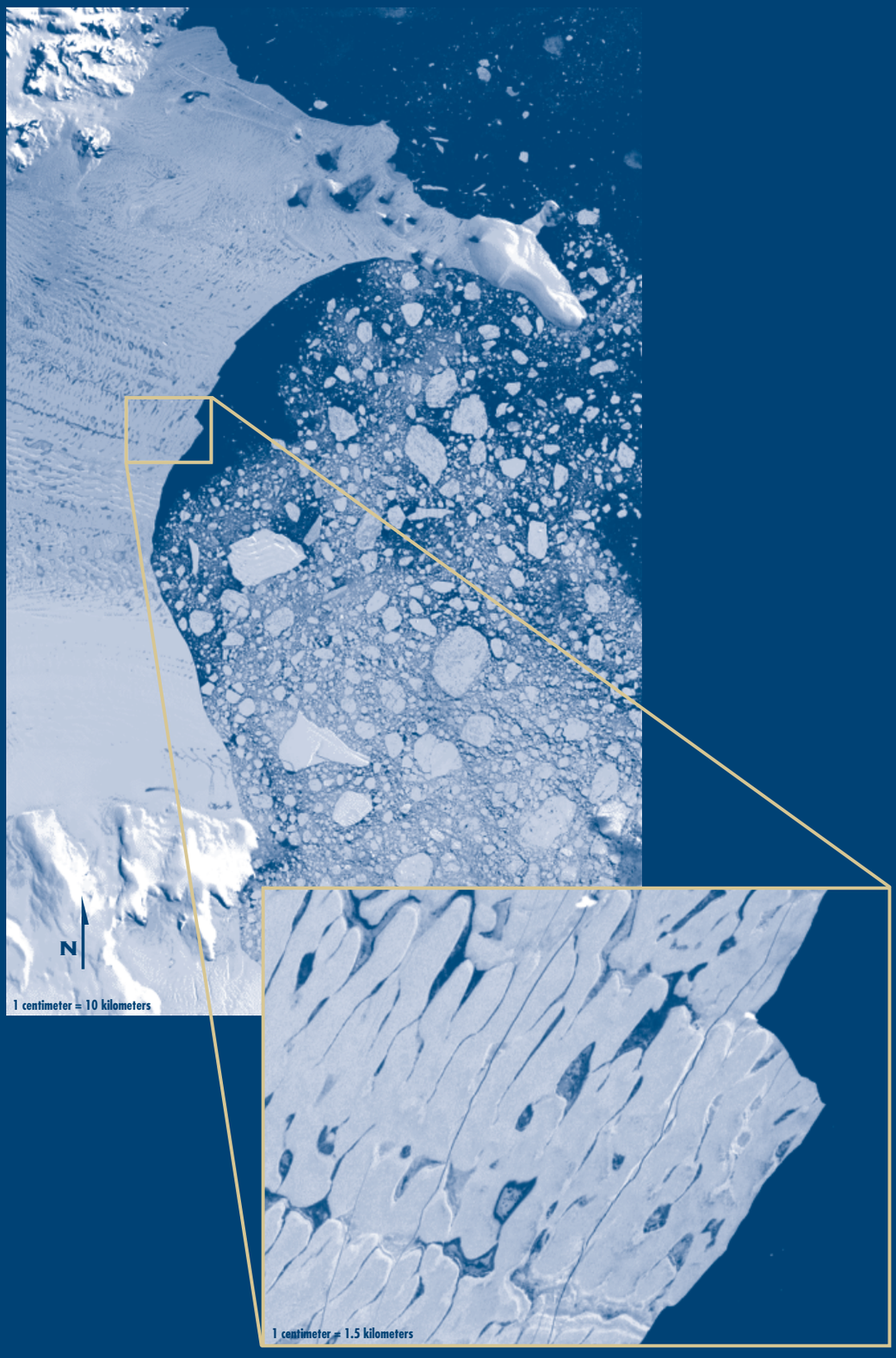
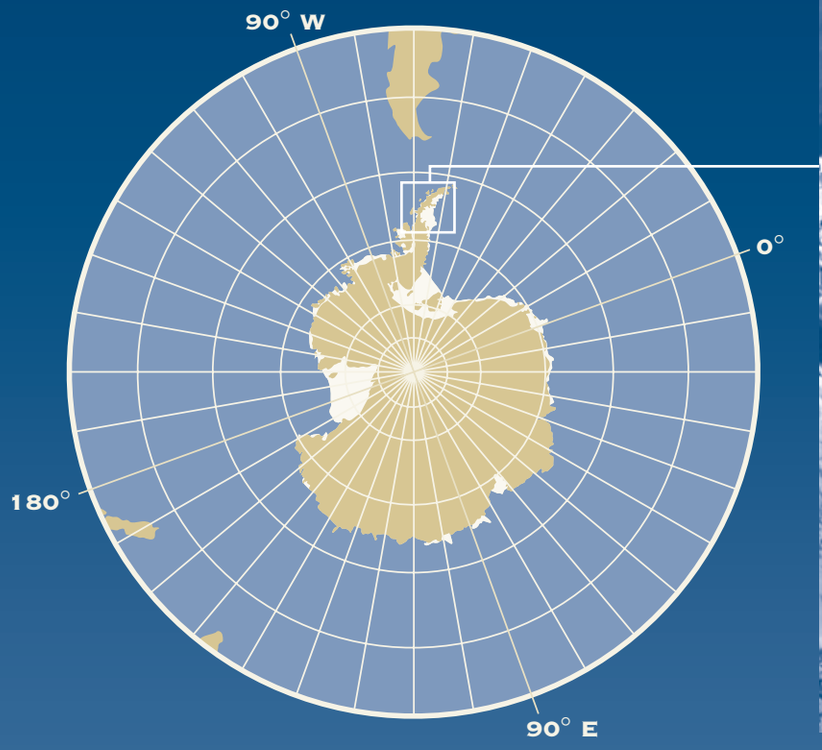
Breakup of an Antarctic Ice Shelf



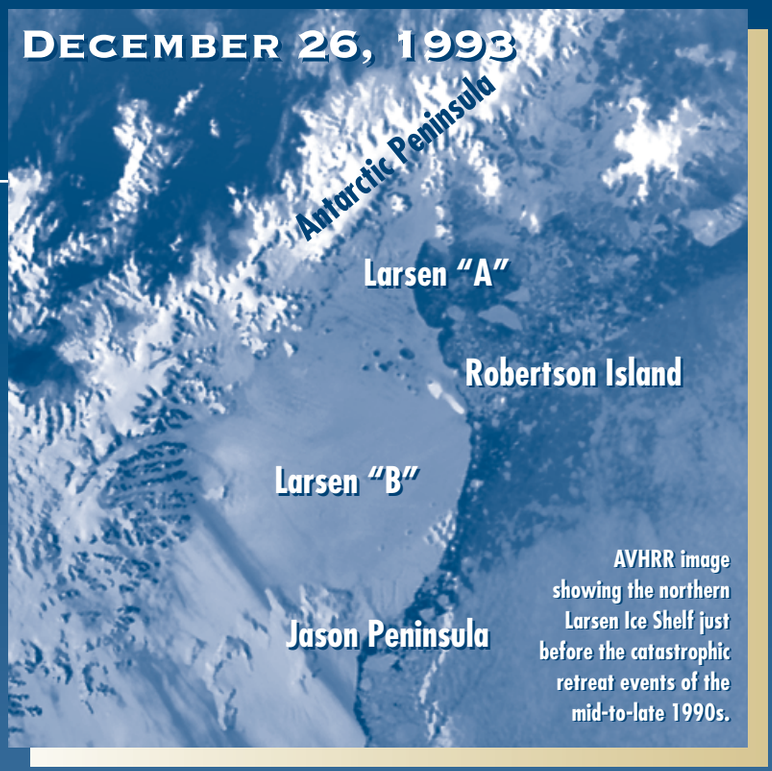
Larsen B Ice Shelf

Data & Information
from the NASA DAACs and Cooperating Data Centers

EARTH SCIENCE DATA



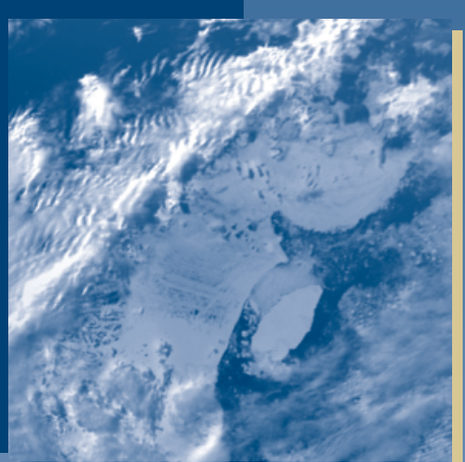
December 26, 1993



AVHRR image showing the northern Larsen Ice Shelf just before the catastrophic retreat events of the mid-to-late 1990s.

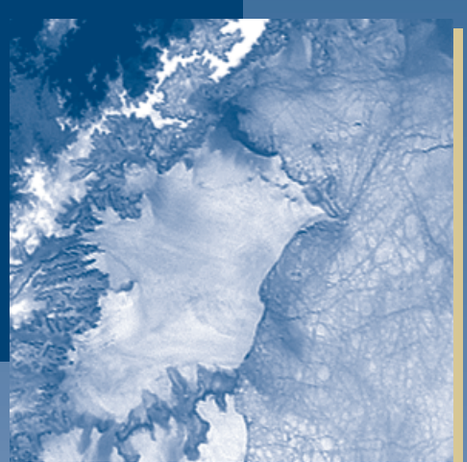
February 13, 1995

Retreat of the Larsen B Ice Shelf began after a severe storm in January 1995 when a large iceberg broke off the shelf. This storm also marked the demise of Larsen A. The large white area to the north of the calved iceberg represents thousands of small icebergs, the remnants of Larsen A, that drifted out to sea as a result of disintegration. Melt ponds that formed during the unusually warm summer appear as small dark spots on Larsen B.



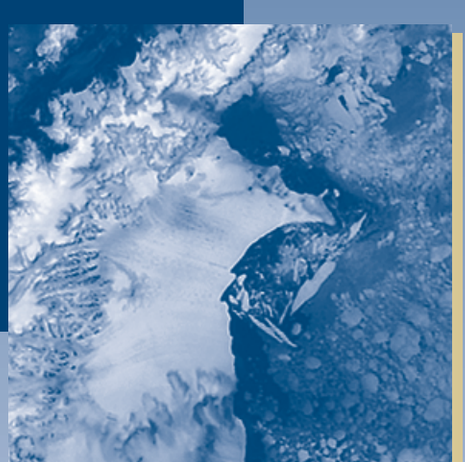
March 21, 1998

A new embayment was created along the seaward edge of the ice shelf where melt ponding most commonly occurred. This event indicated a loss of approximately 125 square kilometers of ice shelf and marked the first breakup of the critical "structural arch" region of the shelf (a line between the Jason Peninsula and Robertson Island).



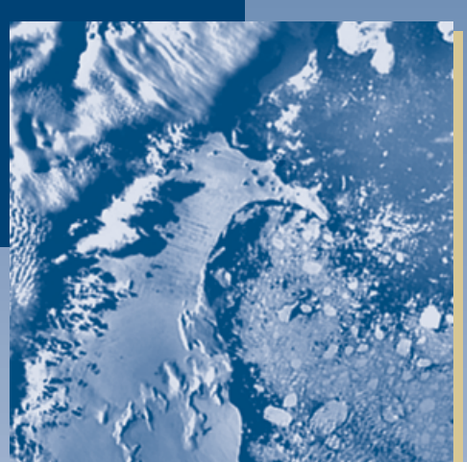
November 21, 1998

Significant breakup and retreat resulted in an estimated loss of 1,168 square kilometers from the ice shelf. Hundreds of small, elongated icebergs calved from the shelf in regions where melt ponding had occurred, leaving the remaining ice poorly buttressed and, therefore, more susceptible to storm and tide action.



March 2, 2000

Further retreat along the northern two-thirds of the shelf front created a deeply embayed shelf. Melt ponds continued to form during the summer, and additional disintegration is expected for the next few years.



NASA DAAC Distributed Active Archive Centers

Front Cover Image: The Landsat 7 image (Path 216, Row 106) acquired on February 21, 2000, shows a detailed picture of the disintegrating eastern edge of the Larsen B Ice Shelf. Dark patches on the northern two-thirds of the shelf indicate melt ponds, a critical component of breakup. The inset shows the close relationship of cracks and melt ponds on the shelf.

NorW001664 LarsonPocket Folder

Scientists are concerned with the speed and extent of disintegration of Larsen B and other Antarctic ice shelves. The National Snow and Ice Data Center (NSIDC) in Boulder, Colorado, is monitoring Antarctic ice shelves using Advanced Very High Resolution Radiometer (AVHRR) data from the National Oceanic and Atmospheric Administration's (NOAA's) polar-orbiting satellites and NSIDC's polar 1-kilometer AVHRR data set. NSIDC regularly reviews images of those ice shelves considered susceptible to rapid change due to climatic warming.

Information on the Larsen Ice Shelf and the AVHRR images on the back cover were provided by the NSIDC Distributed Active Archive Center (DAAC). The Landsat 7 image on the front cover was provided by the United States Geological Survey (USGS) Earth Resources Observation Systems (EROS) Data Center (EDC) DAAC.

The NSIDC and EDC DAACs are two of the National Aeronautic and Space Administration's (NASA's) eight DAACs. The DAACs process, archive, and distribute data from the Earth Observing System (EOS) and other Earth measurement systems to support and promote global change studies.

For more information and to view other satellite images of Antarctic ice shelves, see NSIDC's Web site at http://nsidc.org/iceshelves/

To learn about the DAACs and the data products and services they provide, see the DAAC Web site at http://nasadaacs.eos.nasa.gov

Ice shelves are large floating plates of ice attached to landmasses in the polar regions. They form where islands and sheltering coastlines support large glaciers flowing toward the ocean. Where they become stable, long-term features, ice shelves serve as barriers between glaciers and the open sea, in part stemming the flow of ice off the continent. Ice shelves gain mass from the flow of glaciers and from new snow accumulation. They lose mass primarily by iceberg calving (breaking away) and secondarily by melting.

During the summer when temperatures rise above freezing, snow on the ice shelf melts, covering the surface with lakes. This process is called melt ponding. The melt water increases the extent of fracturing in the ice. As the water seeps into the cracks, its weight forces the cracks to deepen. Refreezing of this water during the winter weakens the shelf and plays a role in breakup.

While iceberg calving is a routine event for ice shelves, disintegration is not. If large ice shelves were to disintegrate, glaciers and ice that had been resting on the continental surface could flow freely into the ocean.

The Larsen B Ice Shelf is located near the tip of the Antarctic Peninsula. Surface features and flow rates indicate that it has existed at least 300 years. In recent years, Larsen B has been in rapid retreat. The once 12,000-square-kilometer ice shelf (roughly the size of Connecticut) is now about 7,000 square kilometers. Since the 1940s, the regional climate has warmed by about 2.5 degrees Celsius. As the average summertime temperature has been inching above freezing, Larsen B has been disintegrating. The recent warming trend has led to greater melt ponding, causing the shelf to weaken through increased fracturing and refreezing. This process shows how a relatively small warming trend can have a regionally profound effect on the physical condition of other Earth systems.